Study of Heart Rate Changes in Different *Salat's* Positions

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Introduction

Salat or the Muslim prayer is a physical as well as a spiritual act involving an obligatory duty to all Muslims and, is the second pillar of the Islamic faith. It is a form of worship towards God. Muslims were ordered to perform *Salat* five times a day.

Salat consists not only of prayer recitation and meditation, but also of body movements and positions. The main body positions involved in *Salat* are standing (*qiyyam*), bowing (*rukuk)*, prostration (*sujud)* and sitting (*tashahhud)* positions. The movements are performed repeatedly, in accordance to the ordained prayer regulations [1].

Heart rate (HR) is a measure of heart beats in a minute, measured in beats per minute (bpm). The seemingly constant and rhythmic nature of HR is produced by the electrical signals from the sinoatrial (SA) node. Impulses for heart rate begin at SA node and its generating rate can change from one time to another time. SA node acts as the principal pacemaker of the heart where potential from the SA node propagates along the atria and reaching second node of the heart, atria ventricular AV [2].

Regulating factors act on the SA node to either increase or decrease the HR to adjust cardiac output to meet the changing needs of the body [3], including the performance of different physical activities and postures [4].

Normal HR in the healthy population is strongly affected by 2 factors: age and exercise. With aging, the heart rate

changes less because of increasingly sedentary lifestyle habits [5]. For healthy adult in resting position, the heart rate for male and female are 70 bpm and 75 bpm, respectively. The normal range of HR during resting is 60-80 bpm while for athletes their HR is lowest 20-40 bpm [6]. Main factors affecting heart rate are: cardiac nerves, body temperature, breathing and chemical substances or medicine [2]. Besides that, during a certain body position where the position of heart relative to the head and the distance between ground (feet) and heart can also influences the HR.

High HR indicates that the heart has to work harder in order to supply sufficient blood to the whole body, especially to the brain. Low HR, on the other hand, indicates that the heart is sufficiently efficient and thus requires less work to supply the same amount of blood to the whole body. Low HR gives the heart additional 'resting' time, and this may prolong the life of the heart [7].

There are many research papers describing the HR changes in different body positions and physical activities [4,8,9] for examples HR during yoga and tai-chi [10,11], but none had ever described the HR in *Salat's* positions. This paper tries to describe and document the pattern of HR changes in healthy subjects in different *Salat's* positions

METHODOLOGY

A total of 24 subjects (10 males and 14 females), with age ranging from 20 to 36 years old (mean 23) and body mass index, BMI (mean 23 kg m^{-2}), were recruited for this study. The subjects are physically healthy and able to perform each of the *Salat's* position. The subjects were asked not to indulge in any vigorous physical activity or take any meal for at least two hours prior to the measurement.

The equipment used to measure the HR is the 4-leads Schiller AT-102 electrocardiogram (ECG) (Schiller AG,

Baar, Switzerland). An ECG is a graphic produced by electrocardiograph which is used in this study to record the cardiac voltages. An ECG is a surface measurement of electrical activity in cardiac tissue. For each cardiac cycle, the potential between two points on the body surface will vary in a characteristics manner, which is a PQRST waveform as shown in Figure 1. RR interval (ms) in this waveform is

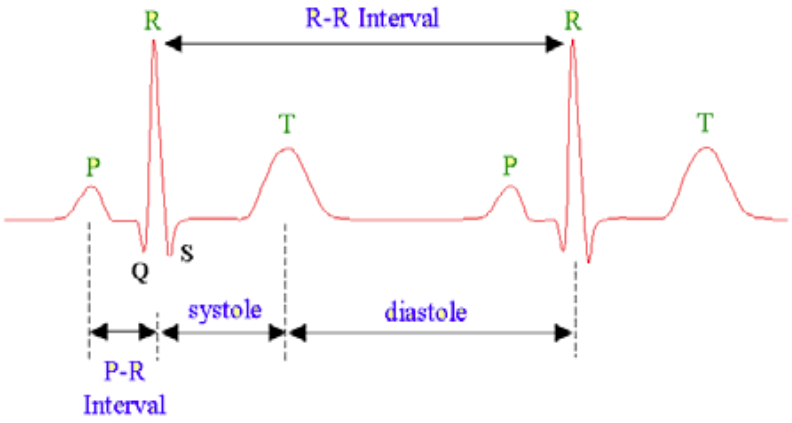

Fig. 1: Normal PQRST waveform [12]

used to calculate the HR, however, the HR can also be calculated from PP, SS or TT intervals [2] as shown in equation 1:

Please refer to the full text

Four leads attached to the subject's chest (Figure 2) and each of the subjects was asked to rest on a chair for 5 minutes to record the resting HR. The subjects were then asked to perform each of the *Salat's* positions within certain duration of time (Figure 3). Resting is defined as sitting on a chair position to stabilize the HR. The resting HR position is the control. The duration has been determined previously as the average time.

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